sels of the breathing organs, from which it returns directly to the heart.

The mode in which the breathing organs of this animal are supplied with water, makes it evident, in Mr. Home's opinion, that all similar animals which have no cavity for the reception of sea water, must have their breathing organs placed externally; and he thinks that the beautiful membranous expansions displayed by those species of Actiniæ, called in the West Indies animal flowers, are, in fact, the breathing organs of those animals; and not, as their appearance formerly led Mr. Home to believe, tentacula for catching food.

The *Teredo gigantea*, when arrived at its full growth, closes up its shell; so also does the *Teredo Navalis*. Hence Sellius was led to suppose that the animal, by this act, formed its own tomb. This, however, is not the case; since, in some specimens in Mr. Griffiths's possession, the animal appears to have receded from its first inclosure, and to have formed a second, three inches up the tube, and afterwards a third, two inches further on. These facts show that the *Teredo gigantea*, when arrived at its full growth, closes up its shell, and lives a long time afterwards, being furnished with food from the sea by means of its tentacula. The *Teredo Navalis* closes up its shell in the same manner; it must therefore, after that period, be supplied with food through the medium of the sea water; and it is probable that the small tentacula, before described, are for the purpose of catching food.

As the *Teredo gigantea* bores in mud, from which it cannot be supposed to receive any part of its nutriment, it may be questioned whether the *Teredo Navalis* receives its support from the wood it destroys, or is wholly supplied with food from the sea. The latter opinion appears to Mr. Home the most probable. The quantity of wood taken into its stomach is, he thinks, by no means sufficient for the support of an animal which has red blood and very perfect organs. He also remarks, that the saw-dust already spoken of did not appear to Mr. Hatchett to have undergone any change.

These animals, having only a slight connexion with their shell at one particular spot, are capable of turning themselves round in their shell; this facility of motion seems evidently to be intended for the purpose of boring.

On the inverted Action of the alburnous Vessels of Trees. By Thomas Andrew Knight, *Esq. F.R.S. In a Letter to the Right Hon. Sir* Joseph Banks, *K.B. P.R.S.* Read May 15, 1806. [*Phil. Trans.* 1806, *p.* 293.]

Mr. Knight, in the papers formerly communicated by him to the Royal Society, endeavoured to prove that the fluid by which the various parts added to trees, &c. are generated, has previously circulated through their leaves, either in the same or in the preceding season, and has subsequently descended through their barks. There is, however, a circumstance stated by Hales and by Du Hamel, which

appears to militate against the above hypothesis, namely, that when two circular incisions are made, at a small distance from each other, through the bark, round the stem of a tree, and the bark between these incisions is wholly taken away; that portion of the stem which is below the incisions continues to live, and to increase in size, though much more slowly than the parts above the incisions. The above-mentioned naturalists have also observed, that a small elevated ridge is formed round the lower lip of the wound, which makes some slight advances to meet the bark and wood, projected in larger quantities from the upper lip of the wound.

Our author, in a former paper, attempted to explain the above circumstance, by supposing that a small part of the true sap, descending from the leaves, escapes downwards, through the porous substance of the alburnum: in another paper he has shown, from the growth of inverted cuttings, the existence of a power in the alburnum to carry the sap in different directions; and he now describes some experiments made in order to show that the conclusions drawn by him are not inconsistent with the facts stated by Hales and Du Hamel; and that although the ascending sap usually rises through the alburnum and central vessels, yet the alburnous vessels appear to be also capable of an inverted action, when such action becomes necessary to preserve the existence of the plant.

The first experiment described in the present paper, consisted in removing the bark by means of circular incisions at the distance of three inches from each other from the stems of several young oaks, as soon as the leaves were nearly full grown, and examining, in the succeeding winter, the state of the parts. In almost every instance the alburnum was found to be lifeless, and almost dry; in one instance, however, it was perfectly alive; and in this the specific gravity of the wood, above the decorticated space, was 1114, and below it 1111, whereas the specific gravity of an unmutilated stem, from the same roots, and at the same distance from the ground, was 1112. Now if the whole of the descending, or true sap, had in the above instance stagnated above the decorticated part, the specific gravity of the wood there ought to have been much greater than it was found to be.

Mr. Knight, conceiving that he should obtain more satisfactory and decisive results from tuberous-rooted plants, now proceeded to make some experiments on the potatoe. The early varieties of this plant, as is well known, afford neither blossoms nor seeds. This circumstance he attributed to the privation of nutriment, from the preternaturally early formation of the tubers; he therefore planted, in the last spring, some cuttings of a very early variety of the potatoe in garden-pots; and when the plants had grown a few inches high, they were secured to sticks, fixed erect in the pots. The mould was then washed away from the base of the stems, so that the plants were suspended in the air, and had no communication with the remaining soil, except by their fibrous roots. Efforts were soon made, by every plant, to produce runners and tuberous roots, but these were de-

stroyed as soon as they became perceptible. An increased luxuriance of growth now took place in all the plants; numerous blossoms were emitted, and every blossom afforded fruit.

In another experiment Mr. Knight, taking great care to prevent the formation of tubers on any other part of the plant, permitted them to form on the extremities of the lateral branches; these being the points most distant from the earth, in which the tubers are naturally deposited. Many of the joints of the plants became enlarged; and our author thinks, that if the formation of tubers had been totally prevented, these joints would have acquired an organization capable of affording plants in the succeeding spring.

In another variety of the potatoe, which was very luxuriant in lateral branches, Mr. Knight detached many of those branches from the principal stem, letting them, however, remain suspended by such a portion of alburnous and cortical fibres and vessels as was sufficient to preserve life. The result was, that the true sap, instead of returning down the principal stem into the ground, remained, and formed small tubers at the base of the leaves of the depending branches.

To ascertain whether the tubers would be fed when the passage of the true sap down the cortical vessels was interrupted, a portion of the bark, five lines in width, was removed from the stems of several potatoe plants, close to the surface of the ground, soon after the tubers had begun to be formed. The tubers continued to grow, but did not attain their natural size; partly, our author supposes, from the declining health of the plant, and partly from the stagnation of a portion of the true sap above the decorticated part.

The preceding experiments, Mr. Knight admits, do not prove that the fluid contained in the leaf passes downward through the decorticated space to be subsequently discharged into the bark below it; but he has, he says, found that if the amputated branches of different trees have their leaves immersed in water, a portion of that fluid will be absorbed, and will be carried downwards, by the alburnum, into the bark below a decorticated space; so that the insulated bark will be preserved alive and moist during several days. If the moisture absorbed by a leaf can be thus transferred, it appears very probable that the true sap will pass through the same channel. A considerable portion of that sap certainly stagnates above the wound, and a great part of that which escapes into the bark below the wound, is probably carried into the root. But some of that fluid will be carried upwards, by capillary attraction, and will stagnate on the lower lip of the wound, where, in Mr. Knight's opinion, it generates the small portion of wood and bark described by Hales and Du Hamel.

Our author concludes his paper by stating, that he has in his possession a piece of a fir-tree, from which a portion of bark, extending round its whole stem, had been taken off several years before the tree was felled. And he has ascertained that the specific gravity of the wood above the decorticated space is 0·590, that below it only 0·491; and having steeped pieces of each part, weighing 100 grains,

in water during twelve hours, he found that the latter had absorbed 69 grains, the former only 51. Hence he thinks considerable advantage may be expected from stripping off a portion of the bark from resinous trees, all round their trunks, close to the surface of the ground, in the beginning of the summer preceding the autumn in which they are to be felled. He even thinks it probable, that the timber would be improved by letting them stand a second year; although he admits that some loss would be sustained by the slow growth of the trees in the second summer.

It may, Mr. Knight says, be suspected, that the increased solidity of the fir-wood above described was confined to the part contiguous to the decorticated space; but it is well known that taking off a portion of bark round the branch of a fruit-tree, occasions in the succeeding season an increased quantity of blossoms on every part of that branch. This increase probably owes its existence to a stagnation of the true sap, extending to the extremities of the branch; and it may therefore be expected that the alburnous matter of the trunk and branches of a resinous tree will be rendered more solid by a similar operation.

A new Demonstration of the Binomial Theorem, when the Exponent is a positive or negative Fraction. By the Rev. Abram Robertson, *A.M. F.R.S. Savilian Professor of Geometry in the University of Oxford. In a Letter to* Davies Giddy, *Esq. F.R.S.* Read June 5, 1806. [*Phil. Trans.* 1806, *p.* 305.]

This paper is merely an extension of one formerly communicated to the Society by Mr. Robertson, and printed in the Philosophical Transactions for the year 1795. It is, the author says, so far as relates to the raising of integral powers, the same as that paper, and is confessedly new only to the extent mentioned in the title, namely, that the present demonstration is applicable when the exponent is a positive or a negative fraction. The nature of the paper is obviously such, as to render it unsusceptible of abridgement.

New Method of computing Logarithms. By Thomas Manning, *Esq. Communicated by the Right Hon. Sir* Joseph Banks, *K.B. P.R.S.* Read June 5, 1806. [*Phil. Trans.* 1806, *p.* 327.]

If, Mr. Manning observes, there existed as full and extensive logarithmic tables as ever will be wanted, and of whose accuracy we were absolutely certain, and if the evidence for that accuracy could remain unimpaired through all ages, then any new method of computing logarithms would be totally superfluous, so far as concerns the formation of tables, and could only be valuable indirectly, and inasmuch as it might show some curious and new views of mathematical truth. But the above kind of evidence is necessarily impaired by the lapse of time, even while the original record remains, and still more when the record must from time to time be renewed